

What is claimed is:

1. A boundary detection method for detecting a boundary between areas having different features among arbitrary adjacent areas in image data, comprising:
 - extracting feature information depending on all pixels in a unit area for each unit area of the image data;
 - 10 obtaining a difference in the feature information between adjacent unit areas for an arbitrary unit area; and
 - determining as the boundary the unit area whose difference is at or higher than a predetermined level.
- 15 2. A boundary detection method for detecting a boundary between areas having different pixel arrangements among arbitrary adjacent areas in image data, comprising:
 - 20 extracting image frequency information for each unit area of the image data;
 - determining representative feature information according to the extracted image frequency information;
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obtaining a difference in the representative feature information between adjacent unit areas for an arbitrary unit area; and

5 determining as the boundary the unit area whose difference is at or higher than a predetermined level.

3. A boundary detection method for detecting a boundary between areas having different pixel
10 arrangements among arbitrary adjacent areas in image data, comprising:

extracting first image frequency information of predetermined types for each first unit area of the image data;

15 defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative feature information;

provisionally determining as the boundary a
20 first unit area whose variance from the representative feature information of an adjacent first unit area is at or higher than a predetermined level in an arbitrary first unit area;

25 extracting second image frequency information

for each second unit area smaller than the first unit area in the first unit area provisionally determined as the boundary and a vicinal area of the first unit area; and

5 determining as the boundary a second unit area whose value based on the variance from the second image frequency information of the adjacent second unit area is at or higher than a predetermined level in an arbitrary second unit area.

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4. A boundary detection method for detecting, in input image data of an original whose front image is input with a background board as its background, a boundary between the background board and the original for the input image data of an image of a part of the background board and an edge of the original input in a same color; comprising:

15 performing a Fourier-transform on each first unit area of the input image data;

20 extracting first image frequency information of predetermined types obtained by the Fourier-transform processing;

 defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative

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feature information for each of the first unit area;

provisionally determining as the boundary a corresponding area on an approximate line obtained
5 by performing line approximation on a first unit area whose variance from the representative feature information about an adjacent first unit area is at or higher than a predetermined level in an arbitrary first unit area;

10 performing a Fourier-transform on each second unit area smaller than the first unit area in the first unit area provisionally determined as the boundary and a vicinal area of the first unit area;

extracting second image frequency information
15 of predetermined types obtained by the Fourier-transform;

defining as representative feature information a value obtained by adding a predetermined weight to each type of the extracted second image
20 frequency information for each second unit area;

performing a Wavelet transform on the representative feature information;

performing line approximation on a second unit area whose value for each second unit area obtained
25 by the Wavelet transform is at or higher than a

predetermined level; and

determining a position on the approximate line obtained by the line approximation as the boundary.

- 5 5. The method according to claim 4, wherein
 in image data in which the original is
 surrounded by the background board, the boundary is
 detected from four different directions parallel or
 orthogonal to each other on the image data.
- 10 6. The method according to claim 1, wherein
 a printing area is first designated for the
 image data, and image data from which the printing
 area is excluded is defined as a target for
15 detecting the boundary.
7. The method according to claim 2, wherein
 a printing area is first designated for the
 image data, and image data from which the printing
20 area is excluded is defined as a target for
 detecting the boundary.
8. The method according to claim 3, wherein
 a printing area is first designated for the
25 image data, and image data from which the printing

area is excluded is defined as a target for detecting the boundary.

- 5 9. The method according to claim 4, wherein
 a printing area is first designated for the
input image data, and input image data from which
the printing area is excluded is defined as a
target for detecting the boundary.
- 10 10. The method according to claim 1, wherein
 said feature information comprises a high
frequency element, a low frequency element, a
direct current element, and a frequency
distribution.
- 15 11. The method according to claim 5, wherein
 when the determined boundary forms a rectangle,
cant correction is performed on an area contained
in the rectangle based on the boundary.
- 20 12. The method according to claim 5, wherein
 based on the determined boundary, one area
adjacent to the boundary or an original portion of
the image data is left, and the other area or a
25 background board of the image data is removed.

13. The method according to claim 11, wherein

based on the determined boundary, one area adjacent to the boundary or an original portion of the image data is left, and the other area or a background board of the image data is removed.

14. The method according to claim 5, wherein:

based on the determined boundary, one area adjacent to the boundary or a background board portion of the image data is colored in black; and

a character contained in the other area adjacent to the boundary than the area colored in black is recognized.

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15. The method according to claim 11, wherein:

based on the determined boundary, one area adjacent to the boundary or a background board portion of the image data is colored in black; and

a character contained in an area adjacent to the boundary other than the area colored in black is recognized.

16. A computer-readable handy storage medium storing a program used to direct a computer to

perform a process of detecting a boundary between areas having different features among arbitrary adjacent areas in image data, comprising the functions of:

5 extracting feature information depending on all pixels in a unit area for each unit area of the image data;

 obtaining a difference in the feature information between adjacent unit areas for an
10 arbitrary unit area; and

 determining as the boundary the unit area whose difference is at or higher than a predetermined level.

15 17. A computer-readable handy storage medium storing a program used to direct a computer to perform a process of detecting a boundary between areas having different pixel arrangements among arbitrary adjacent areas in image data, comprising
20 the functions of:

 extracting image frequency information for each unit area of the image data;

 determining representative feature information according to the extracted image frequency
25 information;

obtaining a difference in the representative feature information between adjacent unit areas for an arbitrary unit area; and

5 determining as the boundary the unit area whose difference is at or higher than a predetermined level.

18. A computer-readable handy storage medium storing a program used to direct a computer to
10 perform a process of detecting a boundary between areas having different pixel arrangements among arbitrary adjacent areas in image data, comprising the functions of:

extracting first image frequency information
15 of predetermined types for each first unit area of the image data;

defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative
20 feature information;

provisionally determining as the boundary a first unit area whose variance from the representative feature information of an adjacent first unit area is at or higher than a
25 predetermined level in an arbitrary first unit

area;

extracting second image frequency information
for each second unit area smaller than the first
unit area in the first unit area provisionally
5 determined as the boundary and a vicinal area of
the first unit area; and

determining as the boundary a second unit area
whose value based on the variance from the second
image frequency information of the adjacent second
10 unit area is at or higher than a predetermined
level in an arbitrary second unit area.

19. A computer-readable handy storage medium
storing a program used to direct a computer to
15 perform a process of detecting, in input image data
of an original whose front image is input with a
background board as its background, a boundary
between the background board and the original for
the input image data of an image of a part of the
20 background board and an edge of the original input
in the same color; comprising the functions of:

performing a Fourier-transform on each first
unit area of the input image data;

extracting first image frequency information
25 of predetermined types obtained by the Fourier-

transform processing;

defining a value obtained by adding a
predetermined weight to each type of the extracted
first image frequency information as representative
5 feature information for each of the first unit
areas;

provisionally determining as the boundary a
corresponding area on an approximate line obtained
by performing line approximation on a first unit
10 area whose variance from the representative feature
information about an adjacent first unit area is at
or higher than a predetermined level in an
arbitrary first unit area;

performing a Fourier-transform on each second
15 unit area smaller than the first unit area in the
first unit area provisionally determined as the
boundary and a vicinal area of the first unit area;

extracting second image frequency information
of predetermined types obtained by the Fourier-
20 transform;

defining as representative feature information
a value obtained by adding a predetermined weight
to each type of the extracted second image
frequency information for each second unit area;

25 performing a Wavelet transform on the

representative feature information;

performing line approximation on a second unit area whose value for each second unit area obtained by the Wavelet transform is at or higher than a
5 predetermined level; and

determining a position on the approximate line obtained by the line approximation as the boundary.

20. The storage medium according to claim 19,
10 wherein

said program further directs the computer to realize the function of detecting, in image data in which the original is surrounded by the background board, the boundary from four different directions
15 parallel or orthogonal to each other on the image data.

21. The storage medium according to claim 16, wherein

20 said program further directs the computer to realize the function of first designating a printing area for the image data, and defining image data from which the printing area is excluded as a target for detecting the boundary.

22. The storage medium according to claim 17,
wherein

said program further directs the computer to
realize the function of first designating a
5 printing area for the image data, and defining
image data from which the printing area is excluded
as a target for detecting the boundary.

23. The storage medium according to claim 18,
10 wherein

said program further directs the computer to
realize the function of first designating a
printing area for the image data, and defining
image data from which the printing area is excluded
15 as a target for detecting the boundary.

24. The storage medium according to claim 19,
wherein

said program further directs the computer to
20 realize the function of first designating a
printing area for the input image data, and
defining input image data from which the printing
area is excluded as a target for detecting the
boundary.

25. The storage medium according to claim 16,
wherein

said feature information comprises a high
frequency element, a low frequency element, a
5 direct current element, and a frequency
distribution.

26. The storage medium according to claim 20,
wherein

10 said program further directs the computer to
perform cant correction on an area contained in the
rectangle based on the boundary when the determined
boundary forms a rectangle.

15 27. The storage medium according to claim 19,
wherein

said program further directs the computer to
leave one area adjacent to the boundary or an
original portion of the image data, and remove the
20 other area or a background board of the image data
based on the determined boundary.

28. The storage medium according to claim 19,
wherein

25 said program further directs the computer to

perform the functions of:

coloring one area adjacent to the boundary or a background board portion of the image data in black based on the determined boundary; and

5 recognizing a character contained in an area adjacent to the boundary other than the area colored in black.

29. An image processing device for detecting a
10 boundary between areas having different features among arbitrary adjacent areas in image data, comprising:

a feature emphasis unit extracting feature information depending on all pixels in a unit area
15 for each unit area of the image data; and

a boundary determination unit obtaining a difference in the feature information between adjacent unit areas for an arbitrary unit area, and determining as the boundary the unit area whose
20 difference is at or higher than a predetermined level.

30. An image processing device for detecting a
boundary between areas having different pixel
25 arrangements among arbitrary adjacent areas in

image data, comprising:

a feature emphasis unit extracting image frequency information for each unit area of the image data; and

5 a boundary determination unit determining representative feature information according to the extracted image frequency information, obtaining a difference in the representative feature information between adjacent unit areas for an
10 arbitrary unit area, and determining as the boundary the unit area whose difference is at or higher than a predetermined level.

31. An image processing device for detecting a
15 boundary between areas having different pixel arrangements among arbitrary adjacent areas in image data, comprising:

a feature emphasis unit extracting first image frequency information of predetermined types for
20 each first unit area of the image data;

a boundary provisional determination unit defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative feature
25 information, and provisionally determining as the

boundary a first unit area whose variance from the representative feature information of an adjacent first unit area is at or higher than a predetermined level in an arbitrary first unit area; and

5 a boundary determination unit extracting second image frequency information for each second unit area smaller than the first unit area in the first unit area provisionally determined as the
10 boundary and a vicinal area of the first unit area, and determining as the boundary a second unit area whose value based on the variance from the second image frequency information of the adjacent second unit area is at or higher than a predetermined
15 level in an arbitrary second unit area.

32. An image processing device for detecting, in input image data of an original whose front image is input with a background board as its background,
20 a boundary between the background board and the original for the input image data of an image of a part of the background board and an edge of the original input in a same color; comprising:

 a feature emphasis unit performing a Fourier-
25 transform on each first unit area of the input

image data, and extracting first image frequency information of predetermined types obtained by the Fourier-transform processing;

5 a boundary provisional determination unit defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative feature information for each of the first unit area, and provisionally determining as the boundary a
10 corresponding area on an approximate line obtained by performing line approximation on a first unit area whose variance from the representative feature information about an adjacent first unit area is at or higher than a predetermined level in an
15 arbitrary first unit area; and

a boundary determination unit performing a Fourier-transform on each second unit area smaller than the first unit area in the first unit area provisionally determined as the boundary and a
20 vicinal area of the first unit area, extracting second image frequency information of predetermined types obtained by the Fourier-transform, defining as representative feature information a value obtained by adding a predetermined weight to each
25 type of the extracted second image frequency

information for each second unit area, performing a Wavelet transform on the representative feature information, performing line approximation on a second unit area whose value for each second unit
5 area obtained by the Wavelet transform is at or higher than a predetermined level, and determining a position on the approximate line obtained by the line approximation as the boundary.

10 33. The device according to claim 32, wherein
each of said units functions in four different directions parallel or orthogonal to each other on the image data in which an original is surrounded by the background board.

15 34. The device according to claim 29, further comprising
a printing area exclusion unit excluding a printing area of the image data from targets from
20 which a boundary between areas having different features is detected.

35. The device according to claim 29, wherein
said feature information comprises a high
25 frequency element, a low frequency element, a

direct current element, and a frequency distribution.

36. The device according to claim 32, further
5 comprising

an image reading unit optically reading an original and generating the image data of the original.

10 37. The device according to claim 33, further comprising

a cant correction unit for correcting cant of an area contained in a rectangle when the determined boundary forms the rectangle.

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38. The device according to claim 32, further comprising

20 an image exclusion unit leaving one area adjacent to the boundary or an original portion of the image data, and removing the other area or a background board of the image data based on the determined boundary.

39. The device according to claim 32, further
25 comprising:

an image coloring unit coloring one area adjacent to the boundary or a background board portion of the image data in black based on the determined boundary; and

5 a character recognition unit recognizing a character contained in an area adjacent to the boundary other than the area colored in black.

40. A copying machine which provides a background
10 board on a back of an original, reads image information about the original, and outputs a copy of the original with a size of the original designated based on detection of a boundary between the background board and the original, comprising:

15 a printing area exclusion unit excluding a printing area of image information;

 a feature emphasis unit extracting feature information depending on all image information in a unit area for each unit area of the image
20 information; and

 a boundary determination unit obtaining a difference in the feature information between adjacent unit areas for an arbitrary unit area, and determining as the boundary the unit area other
25 than the printing area whose difference is at or

higher than a predetermined level.

41. A copying machine which provides a background
board on a back of an original, reads image
5 information about the original, and outputs a copy
of the original with a size of the original
designated based on detection of a boundary between
the background board and the original, comprising:

a printing area exclusion unit excluding a
10 printing area of image information;

a feature emphasis unit extracting image
frequency information for each unit area of the
image information; and

a boundary determination unit determining
15 representative feature information according to the
extracted image frequency information, obtaining a
difference in the representative feature
information between adjacent unit areas for an
arbitrary unit area, and determining as the
20 boundary the unit area other than the printing area
whose difference is at or higher than a
predetermined level.

42. A copying machine which provides a background
25 board on a back of an original, reads image

information about the original, and outputs a copy of the original with a size of the original designated based on detection of a boundary between the background board and the original, comprising:

5 a printing area exclusion unit excluding a printing area of image information;

 a feature emphasis unit extracting first image frequency information of predetermined types for each first unit area of the image information;

10 a boundary provisional determination unit defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative feature information, and provisionally determining as the
15 boundary a first unit area whose variance from the representative feature information of an adjacent first unit area is at or higher than a predetermined level in an arbitrary first unit area; and

20 a boundary determination unit extracting second image frequency information for each second unit area smaller than the first unit area in the first unit area provisionally determined as the boundary and a vicinal area of the first unit area,
25 and determining as the boundary a second unit area

whose value based on the variance from the second image frequency information of the adjacent second unit area is at or higher than a predetermined level in an arbitrary second unit area.

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43. A copying machine which provides a background board on a back of an original, reads image information about the original, and outputs a copy of the original with a size of the original designated based on detection of a boundary between the background board and the original, comprising:

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a printing area exclusion unit excluding a printing area of image information;

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a feature emphasis unit performing a Fourier-transform on each first unit area of the input image information, and extracting first image frequency information of predetermined types obtained by the Fourier-transform processing;

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a boundary provisional determination unit defining a value obtained by adding a predetermined weight to each type of the extracted first image frequency information as representative feature information for each of the first unit areas, and provisionally determining as the boundary a

25

corresponding area on an approximate line obtained

by performing line approximation on a first unit area other than the printing area whose variance from the representative feature information about an adjacent first unit area is at or higher than a
5 predetermined level in an arbitrary first unit area; and

a boundary determination unit performing a Fourier-transform on each second unit area smaller than the first unit area in the first unit area
10 provisionally determined as the boundary and a vicinal area of the first unit area, extracting second image frequency information of predetermined types obtained by the Fourier-transform, defining as representative feature information a value
15 obtained by adding a predetermined weight to each type of the extracted second image frequency information for each second unit area, performing a Wavelet transform on the representative feature information, performing line approximation on a
20 second unit area whose value for each second unit area obtained by the Wavelet transform is at or higher than a predetermined level, and determining a position on the approximate line obtained by the line approximation as the boundary.

44. The copying machine according to claim 43,
wherein

each of said units functions in four different
directions parallel or orthogonal to each other on
5 the image information in which an original is
surrounded by the background board.

45. The copying machine according to claim 40,
wherein

10 a printing area of the image information is
excluded based on a gray scale value.

46. An image processing device for detecting a
boundary between areas having different features
15 among arbitrary adjacent areas in image data,
comprising:

feature emphasis means for extracting feature
information depending on all pixels in a unit area
for each unit area of the image data; and

20 boundary determination means for obtaining a
difference in the feature information between
adjacent unit areas for an arbitrary unit area, and
determining as the boundary the unit area whose
difference is at or higher than a predetermined
25 level.

47. A copying machine which provides a background board on a back of an original, reads image information about the original, and outputs a copy
5 of the original with a size of the original designated based on detection of a boundary between the background board and the original, comprising:

printing area exclusion means for excluding a printing area of image information;

10 feature emphasis means for extracting feature information depending on all image information in a unit area for each unit area of the image information; and

boundary determination means for obtaining a
15 difference in the feature information between adjacent unit areas for an arbitrary unit area, and determining as the boundary the unit area other than the printing area whose difference is at or higher than a predetermined level.

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